



Pressure Systems For Contractors

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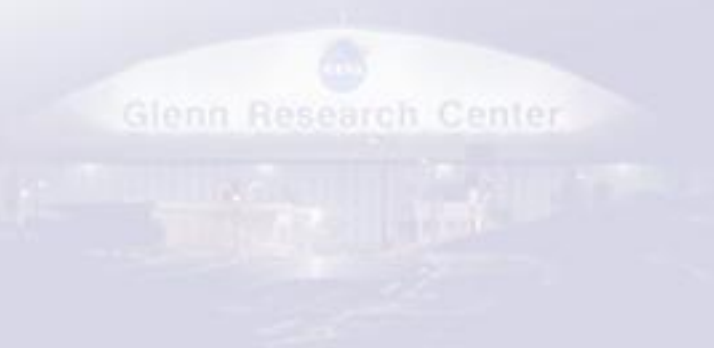
How to Check the PVS Box with Minimal Effort, Expense, Surprises, or Delays

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Why we do it:

- NASA regulations require each center to have a Pressure Vessel and Pressurized Systems (PVS) compliance program
 - NPD 8710.5 - Policy for PVS
 - STD 8719.17 – NASA Requirements for PVS





Why we do it:

- State and federal regulations (e.g. OSHA, CFRs, State of Ohio Law) require PVS be constructed (and repaired) to National Consensus Codes and Standards (NCS)
 - Ohio is a code State (ASME and NBIC codes apply)
 - NASA policy is to NOT exercise Federal Exclusion (i.e. act like a commercial entity)
 - Follow state law with boilers (ASME Section I, Section IV)
 - Follow ASME Section VIII for pressure vessels
 - Follow ASME B31 series piping codes for piping systems
 - Follow NBIC for repairs
 - Follow others reg's as applicable for operations (NFPA, API, etc.)



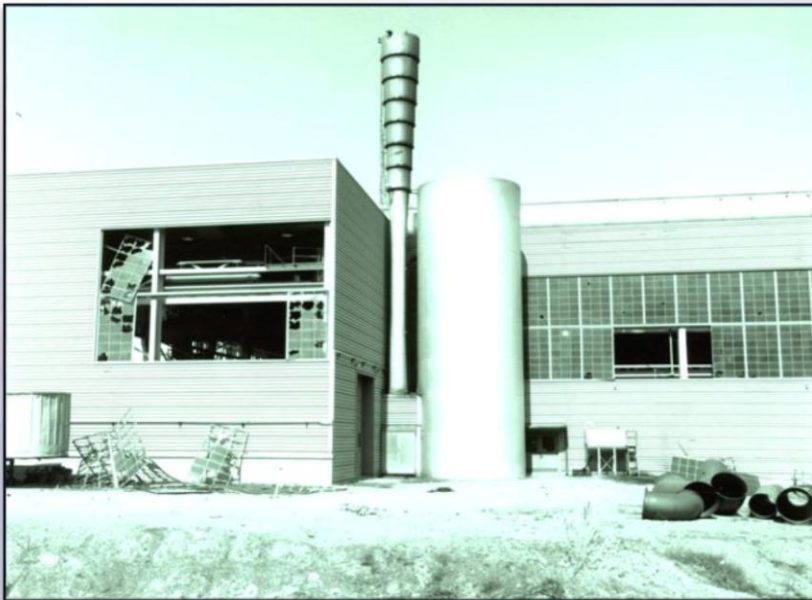
Why it's important:

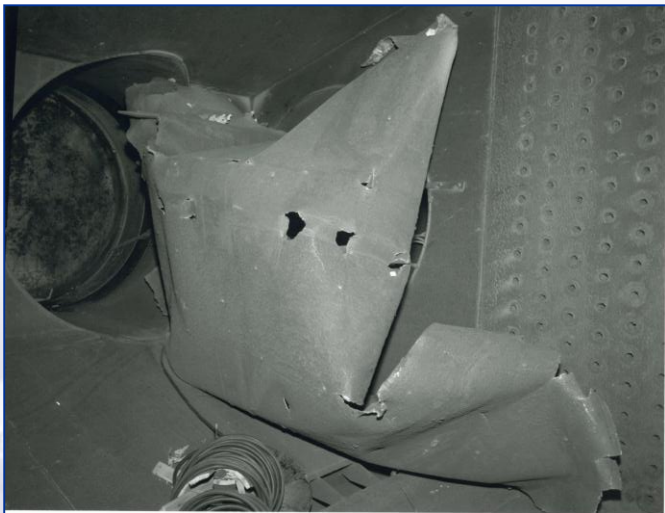
- Bad things can (and do) happen when NCS are not followed. Some Examples:



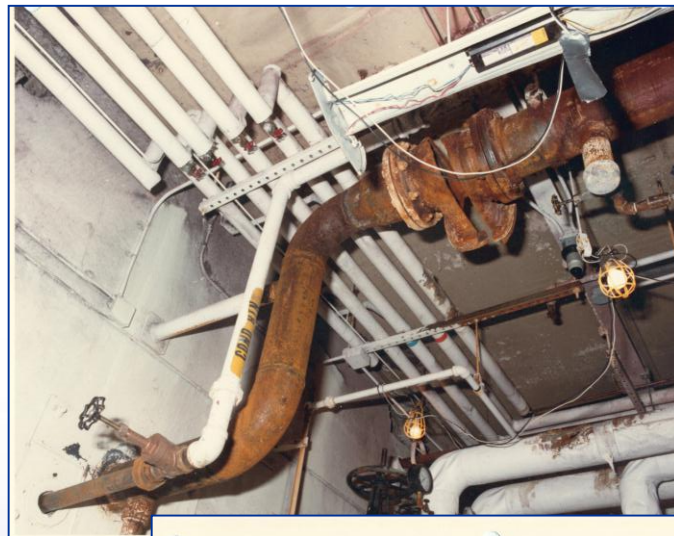


Bldg 64 explosion –
lack of adequate
relief





Implosion of Foster-Wheeler Cooler, Bldg 38 (west wing ERB). Lack of certification/inspection was a determined to be a significant contributing factor in the incident.



Bldg 60 steam line rupture. Cast iron components, not recommended by code, contributed to piping system failure that did considerable damage to library materials. Fortunately, the event occurred off-hours and staff was not in the vicinity. This could have been a truly horrible incident.

Results of a Victaulic Coupling Failure



These cumbersome couplings were used solely to avoid hassles of code compliant welding. For the prepared shop, welding would be considerably cheaper, easier, and quicker construction method.





What it entails:

Simply, all new construction and repairs must comply with applicable NCS:

- Piping must comply with ASME B31 series piping code (typically B31.3 or 31.9) – Note: per code, owner, not contractor, determines applicable code
- All vessels must comply with ASME Section VIII
- Fabrication, installation, examination, and testing must comply with applicable codes
- Pressure Systems Office (PSO) certifies system as code compliant when job is done (some exceptions)
- Pressure Systems Manager (PSM) is responsible for assuring all construction is code compliant, all PVS is certified, and is the Authority Having Jurisdiction (AHJ) for all code interpretation matters



Requirements – general:

- Pressure Vessel fabricators must have current code stamp(s)
- Piping Fabricators should have a Quality Program consistent with ASME piping code
- Assure staff have correct credentials and qualifications – especially welders (more on this later)
- Know basic OSHA safety rules and requirements
- Know basic requirements of Glenn Safety Manual (especially chapter 7, others as applicable)
- Know basic piping code requirements and scopes (esp. ASME B31.3)



Requirements – pre-construction:

- Confirm PSO has verified design as code compliant
- If design-build, assure design is code compliant – ask to have PSO verify
- Assure P&ID drawing exists and is code compliant (or confirm P&ID is not required for the job)
- Collect key component cut sheets/specifications





Requirements – pre-construction:

- Compile a weld map if job involves more than a few welds; assure weld procedures exist, the procedures are qualified, and welders are qualified to do it
- Draft Health and Safety Plan (HASP); address Hot Work and Confined Space permit needs if applicable
- Determine Owners Inspector for PVS portion of job (may not be QA)





Requirements – construction:

- Collect data sheets for major/critical components (e.g. relief valves, gauges, regulators, insulation, etc.)
- Verify fitting specifications/stampings (elbows, tees, weldolets, flanges, etc.)
- Collect mfr certification sheets for critical components (e.g. relief valve cert's, vessel U-1 form, piping Material Test Reports (MTR), Vessel MTR, bellows/expansion joint specifications, etc.)
- Assure piping support and vessel installations are code compliant
- Follow weld requirements and pressure test requirements detailed below



Requirements – welding:

There are two approaches to assuring welds are code compliant and certified:

1. Quality Program:

- Contractor hires an independent third party (i.e. Team or comparable entity) to examine welds, verify welder credentials, and validate process. Results are provided to Government Owner Inspector (OI) for PVS
- This approach can be used for any job, but is essential for larger jobs involving many welds

2. Weld Request Form (GRC 4025):

- Form is filled out and submitted to PSO per form instructions
- Examination is negotiated (typically 3rd party, but can be PSO examiner if QA concurs and provides funds)
- This approach is usually used only for jobs with very few welds



Requirements – welding:

Detail requirements are common to both approaches (see ASME B31.3, ASME Section IX, etc.):

➤ Verify and collect welding documentation to be provided to Owners Inspector:

- Weld Procedure Specification (WPS)
- Procedure Qualification Record (PQR)
- Welding Operator Performance Qualification (WPQ)
- Welder continuity logs
- Weld pre-heat and post weld heat treat records
- Welding rod MTRs and specification records
- Weld map



Requirements – welding:

- Weld procures must be followed for any piping system regardless if the system is certified or excluded (i.e. code welding procedures would be required on an excluded water system)
- Welding on any **pressure vessel** or **code-stamped component** must be accomplished by a shop holding a current R-stamp credential – Only PSM has authority to waive this rule
- R-1 form signed by Authorized Inspector (AI) can be used to certify welds (no need to produce weld procedure and qualification documents in this instance because AI verifies)



Requirements – pressure test:

- Piping/vessel code compliance requires a pressure test.
- The type of pressure test can vary between in-service leak check, hydrotest, pneumatic test, or sensitive leak test depending on:
 - the specific code (e.g. ASME B31.3 vs B31.9 piping code)
 - type of service (e.g. Normal Fluid Service vs Category D Fluid Service)
 - circumstances (e.g. system may not be able to tolerate water for hydrotest).

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Requirements – pressure test:

- The pressure test must be documented – standard code forms or GRC forms can be used for this purpose
- Hydrotest can be accomplished without any special approvals; Pneumatic tests require a permit due to the potential stored energy
- Pressure test requirements are detailed in Glenn Safety Manual (GSM), chapter 7











Requirements – pneumatic test:

- As noted above, pneumatic tests require a permit due to potential stored energy associated with the test
- Procedures and forms for pneumatic test permit are contained in GSM, Ch 7, and involve submitting request form GRC-802 with:
 - Basic description of test noting key pressures
 - Schematic detailing test configuration and key components (see sample below)
 - Relief Device flow capacity calculation (see PSO website) and certification documentation (from mfr or valve shop)
 - Gauge calibration data (from mfr or cal shop)
 - Exclusion Zone calculation (see GSM, Ch 7, App B)

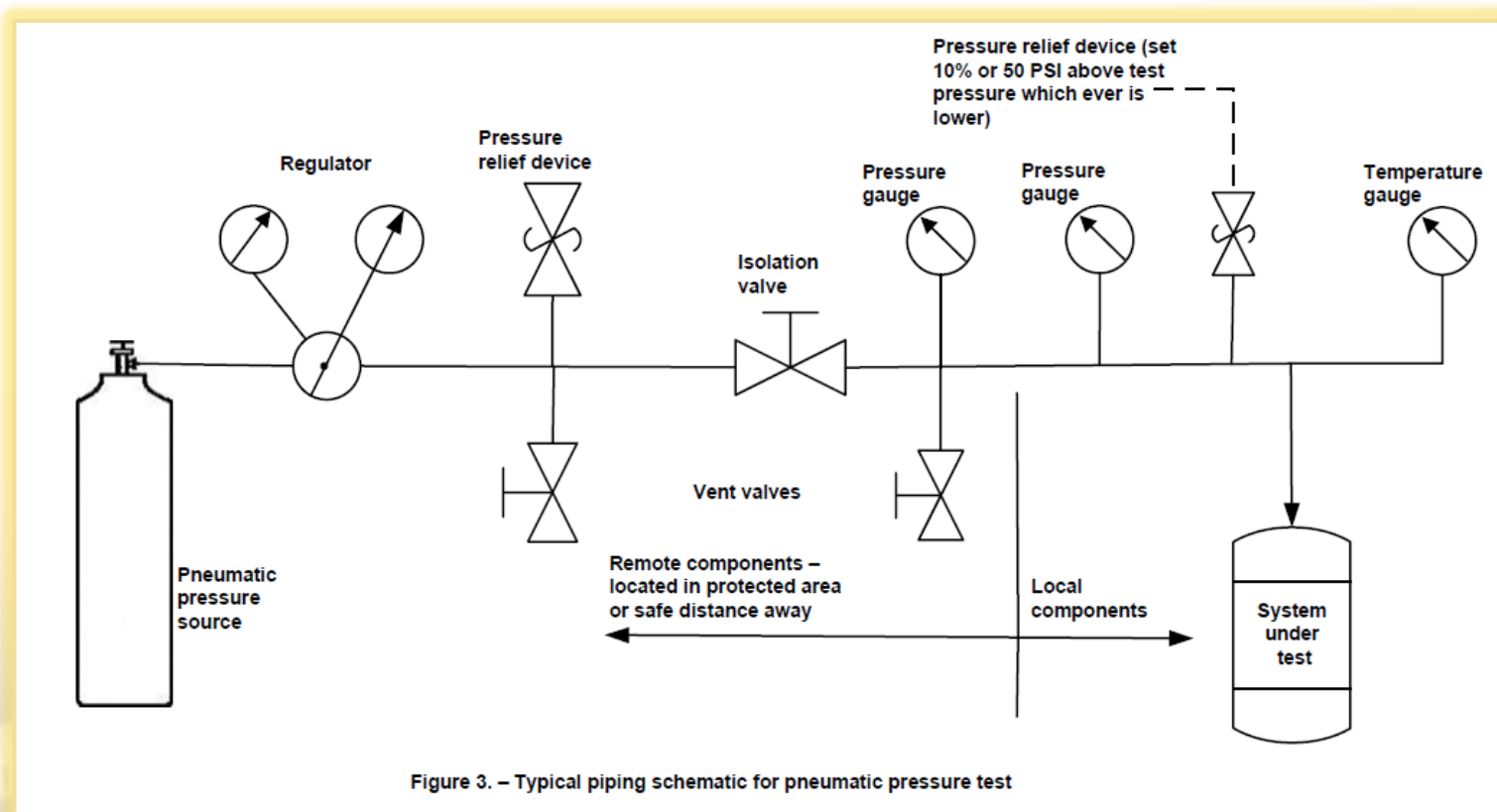


Pneumatic Test Request Form GRC-802

 National Aeronautics and Space Administration	Pneumatic Test Request	Date Received (Completed by PSM)	Permit Number (To be provided by PSO)
Title			
To: Pressure Systems Office		From (Pneumatic Permit Requester, Print name)	
Emergency Contacts (Provide information below for an emergency contact and alternate knowledgeable of activity. The requester can be an Emergency Contact.)		Organization	Work Phone
Name	Work Phone	Home Phone	Mail Stop
Location of Activity (Indicate Facility Name, Number, and Cell)		Expected Duration (mm/yyyy):	
Activity Schedule (Check all that apply) <input type="checkbox"/> Workday <input type="checkbox"/> Night <input type="checkbox"/> Weekend		Start:	Complete:
Describe Activity (If a precedence exists for this activity, provide details including related pneumatic permit number(s).)		Test Run Length (Hours, days):	
Check all supporting documentation attached: <input type="checkbox"/> Pneumatic Test Forms <input type="checkbox"/> Restricted Distance Calculation <input type="checkbox"/> Relief Device Certification <input type="checkbox"/> System P&ID <input type="checkbox"/> System MAWP (Max. Allowable Working Pressure) <input type="checkbox"/> System Component MAWP <input type="checkbox"/> Test Plan <input type="checkbox"/> Barricade Plan <input type="checkbox"/> Relief Device Calculation <input type="checkbox"/> Relief Device Manufacturer's Cut Sheet <input type="checkbox"/> System Component Sheets (Cut Sheets) <input type="checkbox"/> System MAWT (Max. Allowable Working Temp.) <input type="checkbox"/> Test Procedure <input type="checkbox"/> Other _____			
Pneumatic Permit Requester Signature 		Date	Work Phone
Supervisor of Requester (Print name)	Supervisor of Requester Signature 	Date	Work Phone
NASA Technical (Required if Safety Permit Req. is a contractor. Print name)	NASA Technical Signature 	Date	Work Phone
 James Hritz, Safety Engineer	Date	<input type="checkbox"/> Approved <input type="checkbox"/> Denied	Instructions: Send this request and all supporting documentation to the Pressure Systems Manager. Refer to the Glenn Safety Manual, Chapter 7, for additional information.
 Stephen Wnuk, Pressure System Manager	Date	<input type="checkbox"/> Approved <input type="checkbox"/> Denied	

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Pneumatic Test Schematic





Pneumatic test – tips and advice:

- Understand the need for relief – a low pressure test fed from a high pressure source (K-bottle, for example) can become dangerous without proper relief
 - RV sizing calculations are available on PSO website and from standards such API-520
 - Help/guidance is available from PSO or SHeD, yet as the saying goes: 'God helps those who help themselves'
- It is sometimes possible to eliminate need for RV by choosing low pressure source; for example, a pancake compressor that dead-heads at 120 psig
- Be aware the need for calibrated gauges; assure resolution is appropriate for test – electronic pressure devices are often a good alternative



General survival tips and advice:

- Develop a basic understanding/familiarity with ASME codes; especially B31.3 piping code
- Verify basic design is Code Compliant and has been validated by PSO
- Know code welding requirements and strive to meet them – the best (and most profitable) contractors generally have this knocked





General survival tips and advice:

- Know requirements of pneumatic test and ways to simplify:
 - Use low pressure source if possible
 - Avoid pneumatic test via off-site hydrotest if possible
 - Understand RV and calibrated gauge requirements
- Use references and POC's to largest extent possible – PSO strives to partner with contractors in mutual goal of meeting certification with minimal effort/expense





References:

- [Glenn Safety Manual \(GLM-QS-1700.1\)](#)
- [GRC Weld Manual \(GLM-QE-8730.2\)](#)
- [PSO Website](#)
- NASA NPD 8710.5 – NASA Policy Directive for PVS
- NASA STD 8719.17 – NASA Requirements for PVS
- ASME piping and vessel codes (B31 series piping codes and Section VIII Boiler and Pressure Vessel Code)
- NBIC NB-23
- PSO (general procedural info): Andrea Popiel, 3-3183
- PSO (technical info): Calogero DiRienzo, 3-8002
- SHeD (technical info): Jim Hritz, 3-3028
- PSM Steve Wnuk, 3-5748